

CLAIMS

1. A filtration cell capable of direct sampling of a fluid from a container,
the filtration cell comprising:

- 5 (a) a reservoir to receive the fluid to be filtered,
(b) a filter membrane capable of filtering the fluid to provide
a filtrate, the membrane being operatively associated with an opening in the reservoir
such that fluid is able to flow over the filter membrane,
(c) a base to receive the filtrate after it passes through the
10 membrane, the base including a path through which the filtrate is guided to an outlet
from the filtration cell,
(d) a piercing instrument supported in the filtration cell
adapted to pierce a container holding the fluid to be filtered, the piercing instrument
including a hollow interior in open communication with the reservoir and adapted to be
in open communication with an interior of a pierced fluid container, and
15 (e) a flow channel extending between the piercing instrument
and the reservoir such that the hollow interior of the piercing instrument is in
communication with the reservoir through the flow channel, wherein the flow channel is
open to the filter membrane so that fluid to be filtered can be directly passed from a fluid
container over the filter membrane as it is transferred from the hollow interior of the
20 piercing instrument, through the flow channel and into the reservoir.

2. The filtration cell according to claim 1, wherein the piercing
instrument comprises a sharp pointed projection having a first opening therethrough and
a second opening in fluid communication with the reservoir through the flow channel.

3. The filtration cell according to claim 2, wherein the filtration cell
25 comprises a well to contain the filtrate to be analyzed, the well having an opening at the
bottom which is in fluid communication with a filtrate guide path in the base such that
filtrate enters the well through the opening at the bottom to fill the well.

4. The filtration cell according to claim 1, wherein the filtration cell comprises a well to contain the filtrate to be analyzed, the well having an opening at the bottom which is in fluid communication with a filtrate guide path in the base such that filtrate enters the well through the opening at the bottom to fill the well.

5. The filtration cell according to claim 1, wherein the filter membrane is a microporous filter membrane.

6. A process for directly transferring fluid to be filtered from a fluid container to a filtration cell, comprising:

(a) providing a filtration cell comprising a reservoir, a filter membrane operatively associated with an opening in the reservoir, a base configured to receive filtrate passing through the membrane, the base including a path through which the filtrate is guided to an outlet from the filtration cell, a piercing instrument adapted to pierce a container holding the fluid to be filtered, the piercing instrument including a hollow interior in fluid communication with both the reservoir and an interior of a pierced container, and a flow channel extending between the piercing instrument and the reservoir, the flow channel being open to the filter membrane,

(b) providing a container holding a quantity of fluid to be filtered,

(c) piercing the container with the piercing instrument,

(d) providing an airtight connection between the reservoir and a source of air,

(e) alternately pressurizing the reservoir with air, and then releasing the air pressure from the filtration cell such that the fluid reciprocally flows across the filter membrane, and

(f) collecting the filtrate from the membrane.

7. The process according to claim 6, further comprising withdrawing the piercing instrument once sufficient filtrate is collected.

8. The process according to claim 6, wherein step (f) further comprises collecting the filtrate in a well.

9. The process according to claim 8, further comprising directing the filtrate into the well through an opening in a bottom of the well.

5 10. The process according to claim 8, further comprising collecting the filtrate from the filter in the well, and optically monitoring the level of the filtrate in the well to determine when the level reaches a predetermined level.

11. The process according to claim 8 wherein the well is filled through an opening in the bottom when collecting filtrate measured in microliter volumes.

10 12. The process according to claim 6, further comprising optically monitoring the level of fluid in the reservoir and providing a signal indicating when the level of fluid in the reservoir exceeds a maximum or minimum level.

13. The process according to claim 6, wherein the fluid to be filtered is blood.

15 14. The process according to claim 6, wherein the filter membrane is a microporous filter membrane.

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20 15. The process according to claim 6, wherein the filtration cell further comprises a second reservoir in fluid communication with the flow channel between the reservoir and the piercing instrument, step (d) further comprises providing an airtight connection between the second reservoir and the source of air, and step (e) further comprises alternately (i) blocking the flow of air into the reservoir, pressurizing the second reservoir with air, and venting the reservoir to release the air pressure and (ii) blocking the flow of air to the second reservoir, pressurizing the reservoir with air, and venting the second reservoir such that the fluid to be filtered flows initially from the
25 initially from the container to the reservoir then reciprocally from the reservoir to the second reservoir across the filter membrane.

16. The process according to claim 15, wherein the filtration cell further comprises an air inlet port having a passageway therethrough and adapted to receive air

from a pressure source, and the method further comprises pressurizing the container after fluid to be filtered is initially transferred to the reservoir to ensure that a substantial amount of the fluid flows from the container to the reservoir.

17. The process according to claim 6, wherein steps (b) and (c) further
5 comprise providing a container to the piercing point to be pierced using an automated system.

18. The process according to claim 17, wherein the automated system comprises an apparatus which rocks the container prior to providing the container to the piercing point.

10 19. A filtration cell capable of direct sampling of a fluid from a container, the filtration cell comprising:

(a) a first reservoir and a second reservoir to receive the fluid
to be filtered,

15 (b) a filter membrane capable of filtering the fluid to provide a filtrate, the membrane being operatively associated with an opening in the first reservoir and an opening in the second reservoir such that fluid is able to flow over the filter membrane,

(c) a base to receive the filtrate after it passes through the
membrane, the base including a path through which the filtrate is guided to an outlet
20 from the filtration cell,

(d) a piercing instrument supported in the filtration cell
adapted to pierce a container holding the fluid to be filtered, the piercing instrument
including a hollow interior in open communication with the first reservoir and the
second reservoir and adapted to be in open communication with an interior of a pierced
25 fluid container, and

(e) a flow channel extending between the piercing instrument
and the first reservoir and in fluid communication with the first and second reservoirs
such that the hollow interior of the piercing instrument is in communication with the

first and second reservoirs through the flow channel, wherein the flow channel is open to the filter membrane so that fluid to be filtered can be directly passed from a fluid container over the filter membrane as it is transferred from the hollow interior of the piercing instrument, through the flow channel and into the first reservoir and thereafter flow reciprocally from the first reservoir to the second reservoir.

20. The filtration cell according to claim 19, wherein the cell further comprises an air inlet port in fluid communication with a second hollow interior space within the piercing instrument and adapted to receive a pressurizing port.

21. A filtration system capable of direct sampling of a fluid from a container, the filtration system comprising:

(a) a filtration cell, comprising:

- (i) a reservoir to receive the fluid to be filtered,
- (ii) a filter membrane capable of filtering the fluid to provide a filtrate, the membrane being operatively associated with an opening in the reservoir,
- (iii) a base to receive the filtrate after it passes through the membrane, the base including a path through which filtrate is guided to an outlet from the filtration cell,
- (iv) a piercing instrument supported in the filtration cell adapted for piercing a container holding the fluid to be filtered, the piercing instrument including a hollow interior in open communication with the reservoir and adapted to be in open communication with an interior of a pierced fluid container, and
- (v) a flow channel extending between the piercing instrument and the reservoir such that the hollow interior of the piercing instrument is in communication with the reservoir through the flow channel, wherein the flow channel is open to the filter membrane so that fluid to be filtered can be directly passed from a fluid container over the filter membrane as it is transferred from the hollow interior of the piercing instrument, through the flow channel and into the reservoir; and

(b) a filter head in communication with a pressure source and adapted to seal the reservoir.

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22. The filtration system according to claim 21, wherein the system further comprises a second reservoir between the piercing instrument and the reservoir which is in fluid communication with the flow channel, the reservoir and the hollow interior of the piercing instrument, wherein the flow channel extends between the piercing instrument and the second reservoir such that the hollow interior of the piercing instrument is in communication with the reservoir and second reservoirs through the flow channel such that fluid to be filtered can be directly passed from a fluid container over the filter membrane as it is transferred from the hollow interior of the piercing instrument, through the flow channel and into the reservoir and thereafter flow reciprocally from the reservoir to the second reservoir.

23. The filtration system according to claim 22, further comprising an air inlet in fluid communication with the hollow interior of the piercing instrument.